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3G Network Connectivity

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Abstract - 3G is the third generation of wireless technologies. It comes with enhancements over previous wireless technologies, like high-speed transmission, advanced multimedia access and global roaming. 3G is mostly used with mobile phones and handsets as a means to connect the phone to the Internet or other IP networks in order to make voice and video calls, to download and upload data and to surf the net. 3G phones commonly have two cameras since the technology allows the user to have video calls, for which a user-facing camera is required for capturing him/her. Unlike with Wi-Fi which you can get for free in hotspots, you need to be subscribed to a service provider to get 3G network connectivity. We often call this kind of service a data plan or network plan. Thus this paper not only aims to contribute to the already vast field of 3 G Network Connectivity in an effective manner to help but also summarizes.

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3G Network Connectivity

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- Various Data Network
- 3G Overview
- IuCS Interface
- IuPS Interface
- DCN Interface
- Troubleshooting Guidelines

I. Introduction

a) *Various Data Networks*

RDN
Reliance Data Network

RIN
Reliance Internet Network

DCN
Data Communication Network

MEN
Metro Ethernet Network

b) *3G Functional Entities*

- Node B – Base Station
- UE – User Equipment
- RNC – Base Station Controller
- The Iu interface is an external interface that connects the RNC to the Core Network (CN).
- The Uu is also external, connecting the Node B with the User Equipment (UE).
- The Iub is an internal interface connecting the RNC with the Node B
- The Iur is an internal interface connecting two RNCs with each other.

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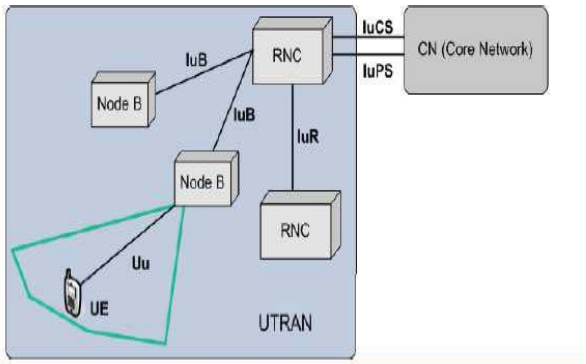
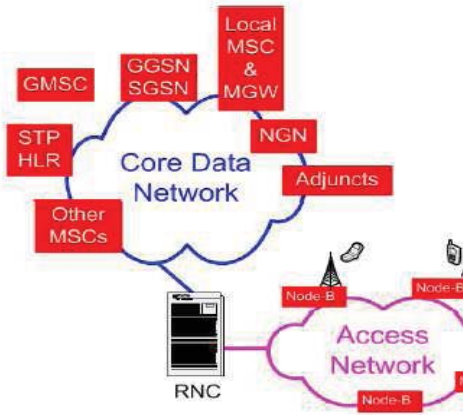
- Reliance MEN network is acting as a IP mobile backhaul Transport connectivity between IuB interface at RNC & NodeBs



II. 3G Overview

In a 3G Setup

- The NodeBs{BTSs (Base Transceiver Stations)} are connected on Access DataNetwork to the RNCs (RadioNetwork Controller)
- The RNCs Connect to 3G Core components (Like MSC /STP / HLR / SGSN/CGSN) on a Core Data Network



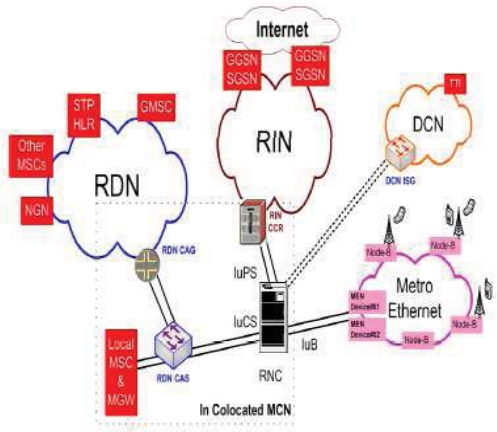
In a 3G Setup on the RNC Side

- The Interface from the RNC towards the Core voice infrastructure is called the IuCS Interface
- The IuCS talks to MSCs / STP / HLR etc for signaling purpose
- The IuCS talks to MGW (Media Gateway) for transmitting voice & video traffic

- The interface from RNC towards the Core Packet infrastructure is called the IuPS interface
- Through the IuPS interface the RNC talks to SGSN/CGSN
- The Interface from RNC to NodeB is the IuB Interface
- It carries both Voice + Video & Data on the same interface towards RNC from the NodeB devices
- There is separate management interface on RNC to give management information to centralized management infrastructure

Various traffic components on a 3G RNC are as under:

- The Voice Traffic (IuCS) flows on RDN
- The Packet data traffic (IuPS) flow on RIN
- The NodeB traffic comes to RNC on the MEN
- The Management traffic flows on DCN

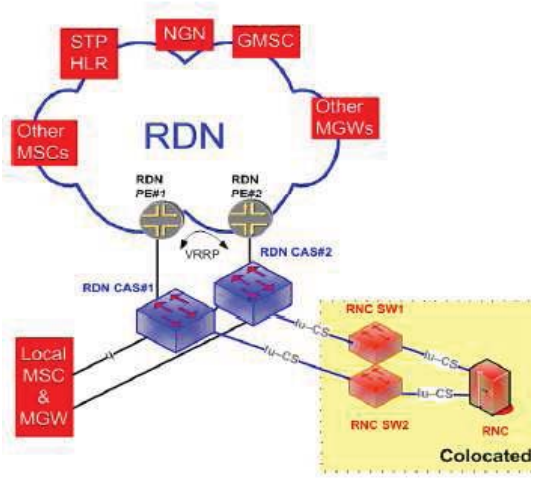


- Two RNC Vendor are selected
- Huawei for the RCOM Circles
- ZTE for the RTL Circle
- From the connectivity
- Architecture perspective there is no difference between two vendors
- There are total 45 RNC across 31 Locations
- RNC is connected to network through RNC Switches
- For HUW RNC the RNC Switch is Cisco 7606 / Cisco 3800
- For ZTE RNCs the Confidential Slide RNC Switch is Cisco 3750

III. IuCS Interface

a) *3G RNC : IuCS Traffic – Collocated Sites*

- The RNCs have dual IuCS interface towards the RNC switch
- For HUW RNC the interface is Optical Gig
- For ZTE RNC the interface is Electrical Gig
- The RNC Switch is a L3 Device
- It runs VRRP for redundancy towards RDN
- And also towards the IuCS ports of RNC
- It runs VRF instance for each traffic type i.e. IuCS –CP i.e. Signaling & IuCS – UP i.e. Bearer traffic (Voice + Video)
- The Uplinks from RNC Switches are terminated on the RDN CAS Switches in a redundant Fashion
- From the RDN CAS to RDN PE it goes on the existing connections
  - The VLANs from RNC to RDN PE are
  - Vlan 416 for Signaling i.e. IuCS - CP
  - Vlan 417 for Media i.e. IuCS - UP
  - Each instance has VRRP on RDN Confidential Slide
- This is applicable for RNC collocated in MCN where RDN presence is there



b) *3G RNC : IuCS Traffic – Non Collocated Sites*

- Wherever the RNC is not collocated with the RDN, the RNC is extended on the Transport Link as shown (e.g. Jamshedpur / Gwalior /Rourkela etc.)
  - Transport links (GEoSDH) are provisioned with 2CNO
  - As per the requirement appropriate VC4s are allocated on the Transport network
- Rest of the architecture is same as the collocated RNC
- The IuR is InterRNC traffic
  - Where all the RNCs are Collocated the IuR traffic doesnot flow on RDN, it gets switched on RNC Switch itself
  - Where all the RNCs are not collocated the IuR traffic gets switched through the RDN (e.g. Faridabad)

IV. IuPS Interface

a) *3G RNC : IuPS Traffic – Collocated Sites*

- The RNCs have dual IuPS interface towards the RNC switch

- For HUW RNC the interface is Optical Gig
- For ZTE RNC the interface is Electrical Gig

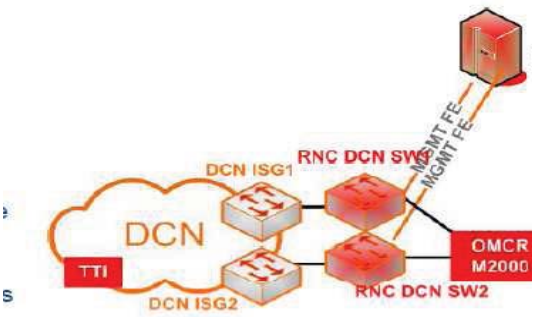
- The RNC Switch is a L3 Device
  - It runs VRRP for redundancy towards RIN
  - And also towards the IuPS ports of RNC
  - It runs one VRF instance forIuPS-CP (Signaling traffic) & IuPS-UP (Data Traffic)
- The Uplinks from RNC Switches are terminated on the RIN in a redundant Fashion
- The VLANs from RNC to RDN PE are
  - Vlan 464 for Signaling i.e. IuPS – CP & bearer traffic i.e. IuPS - UP
- Each instance has VRRP on RIN
- This is applicable for RNC collocated in MCN where RIN presence is there

b) 3G RNC : IuPS Traffic –Non Collocated Sites

- Wherever the RNC is not collocated with the RIN, the RNC is extended on the Transport Link as shown (e.g. Jamshedpur / Gwalior /Rourkela etc.)
  - Transport links GEoSDH are provisioned with 2CNO
  - Appropriate number of VC4s are provisioned as per the bandwidth requirement
- Rest of the architecture is same as the collocated RNC

c) 3G RNC : DCN Traffic –

- The RNCs have dual DCN interface towards the RNC DCN switch
  - For HUW RNC the interface is Electrical Gig
  - For ZTE RNC the interface is Electrical Gig
- The RNC DCN Switch is a L3 Device
  - It runs VRRP for redundancy towards DCN
  - And also towards the DCN ports of RNC
- The Uplinks from RNC DCN Switches are terminated on the DCN Switches in a redundant Fashion
- The RNC DCN Switch & DCN Switch runs VRRP protocol to give redundancy
- On the same RNC DCN Switch OMCR is connected
- At all RNC Locations Dual DCN Switches are present & functional



Redundancy & Fast Convergence

- Path redundancy - MSTP – BN Ring
- Fast convergence triggering mechanism such as VRRP with BFD is proposed to be implemented at RNC to MEN connecting interfaces.

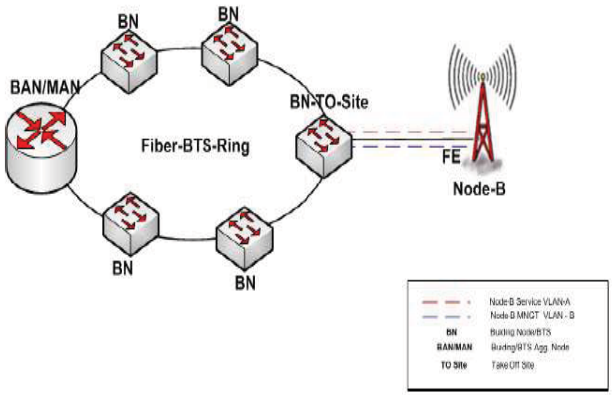
VLAN Assignments

- Management VLAN for Node-B
- Management Vlan for both Huawei and ZTE Node-Bs – VLAN 56
- Node-Bs under one BAN will be placed on a separate management VLAN (VLAN56).
- Management VLAN of Node-B to be passed start from the connecting interfaces of BN nodes till Parenting BAN in the corresponding ring.
- Service VLAN for Node-Bs
- Range of Service Vlan for both Huawei and ZTE Node-Bs – VLAN 1600 –1900
- Each Node-B under one BAN is assigned with separate VLAN for services and attached with the common service VRF created in the BAN.
- Service VLAN of Node-to be passed start from the connecting interfaces of BN nodes till Parenting BAN in the corresponding ring.

Scenario 1 BTS on fiber site

- Node-B Connectivity

- At fiber BTS site MEN NE will be available and it will be part of MEN Ring.
- To keep the FE-FE-14 identical architecture for 3G , Port Number FE 08 to FE are proposed (in case the proposed ports are in use, circle FA deploy team to assign new ports) for connecting the Node-B to MEN switch.
- These ports will be configured as a trunk port. By default Node-B management VLAN 56 will be allowed and service VLAN to be configured against the Node-B service SONode-B to RNC



Scenario Node-B Connectivity

- Node-B is connected behind 1st Hop SDH and

another Node-B connected behind 2nd Hop PDH card.

- For making connectivity from 1st Hop Node-B to Take-off site NE, it has been proposed to install the CX-200 at 1st Hop BTS location below SDH MW connecting to L1 card or IMAP card of SDH NE.
- To make this CX-200 RFS and to carry the Node-B service and Management traffic, bearer needs to be created between this CX-200 to take off site Scenario 3de-B Connectivity
- Two PDH HOP's are terminating on CX-200 installed at 1st Hop BTS location
- FA_DEPLOY_Circle team to give the correct Interface details of take-off site and respective Node-B service SOCo Scenario 4de-B Connectivity
- The IP Radio link terminating on Fiber BTS MEN NE
- Node B –will connect directly to IP Radio for 1st HOP and 2nd Hop Node-B will connect cardto PDH Ethernet card.
- The bearer to be provisioned in each Hop based on availability of bandwidth. In case of IP Radio the bandwidth required other than 2G BTS to be converted to IP radionne

Scenario 5Node-B Connectivity

- The IP Radio link will terminate on Fiber BTS MEN NE and Tail-End NEs are PDH MW
- Deployed CX-200D below IP radio for serving more than one PDH link
- IP Radio has 4 number of ethernet ports , In case of Ethernet port requirement is more than four then we are proposing to commission CX-200D below IP radioc
- Bandwidth Provisioning on NLD path BW to be provisioned in NLD path = (Number of BTS at Bauria x 2) + (Number of BTS in Kulgachia x 2) Mbps aBnWd wtoi dbet hp rPovriosivoniseido inn iMnigcrowave SDH
- 60Mbps on each hop, In case 60Mbps is not available, provisioining can be made based on available bandwidth, provided at least 2Mbps*no. of NodeBs downstream is available.
- BW to be provisioned in IP Radio & Microwave PDH
- Maximum Available Bandwidth (As per NPE-MW guideline IP Radio Port Mapping
- All the ports on IP Radio should be available for carrying traffic. No port should be reserved for CX-200 for OAM. For OAM,

NMS port is available on the IDU.

- Port No. 1 Towards take-off site
- Port No. 2 Towards Tail end
- Port No. 3 Towards Tail end
- Port No. 4 Node-B

V. Troubleshooting Guidelines

Following are the generic troubleshooting guidelines

- Check the physical cabling
- Check the indicators lights of connectivity are glowing at both the ends of the connectivity in subject
- If found ok, ask the RNC team to ping as per the required service
- If issues follow the detailed troubleshooting guidelines given below

a) Troubleshooting Guidelines – IuCS Traffic

- After ensuring Layer1 connectivity is OK, then Login into the RNC Switch & follow the below mentioned guidelines
- Ping the Local IuCS interfaces through appropriate VRF (1)
  - For IuCS-CP traffic it is signaling VRF
  - For IuCS-UP traffic it is Voice VRF
  - If not pinging check the local connectivity
  - If pinging & problem persisting move to following steps
- Ping the Local IuCS RDN interfaces through appropriate VRF (2)
  - If not pinging check the local connectivity
  - If pinging & problem persisting move to following steps
- Ping the End Devices (3)
  - If not pinging escalate to NOC
  - If Pinging the Network connectivity is through, the troubleshooting needs to start on the end devices

b) Troubleshooting Guidelines – IuPS Traffic

- After ensuring Layer1 connectivity is OK, then Login into the RNC Switch & follow the below mentioned guidelines
- Ping the Local IuPS interfaces through appropriate VRF (1)
  - not pinging check the local connectivity
  - If pinging & problem persisting move to following steps
- Ping the Local IuPS RIN interfaces through appropriate VRF (2)
  - If not pinging check the local connectivity
  - If pinging & problem persisting move to following steps 2
  - Ping the End Devices (3)
  - If not pinging escalate to NOC
  - If Pinging the Network connectivity is through, the troubleshooting needs to start on the end 1Devices

c) Troubleshooting Guidelines – DCN Traffic

- After ensuring Layer1 connectivity is OK, then Login into the RNC DCN Switch & follow the below mentioned guidelines
- Ping the Local DCN interfaces (1)
  - not pinging check the local connectivity
  - If pinging & problem persisting move to following steps
- Ping the Local DCN interfaces (2)
  - If not pinging check the local connectivity
  - If pinging & problem persisting move to following steps
- Ping the End Devices (3)
  - If not pinging escalate to NOC
  - If Pinging the Network connectivity is through, the troubleshooting needs to start on the end devices.

VI. Conclusion

Wireless technologies are a way for mobile users to make free or cheap calls worldwide and save a lot of money due to the latest telephony applications and services. 3G networks have the advantage of being available on the move, unlike Wi-Fi, which is limited to a few meters around the emitting router. So, a user with a 3G phone and a 3G data plan is well-equipped for making free mobile calls. She will only have to download one of the free applications and install on her mobile phone and start making calls